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## Application of X-ray Lasers to Probe High Density Plasmas*

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The reliability and characteristics of collisionally pumped soft x-ray lasers make them ideal for a wide variety of plasma diagnostics. These systems now operate over a wavelength range extending from 35 to 400 Å and have output energies as high as 10 mJ in 150 ps pulses. The beam divergence of these lasers is less than 15 mrad and they have a typical linewidth of $\Delta\lambda/\lambda \sim 10^{-4}$ making them the brightest xuv sources available. In this talk I'll describe our use of x-ray lasers to probe high density plasmas using a variety of diagnostic techniques. Taking advantage of recently developed multilayer beamsplitters we have constructed and used a Mach-Zehnder interferometer operating at 155 Å to probe 1-3 mm size laser produced plasmas with peak electron densities of $4\times10^{21}\text{cm}^{-3}$. A comparison of our results with computer simulations will be presented. We have also used x-ray lasers and a multilayer mirror imaging system to study hydrodynamic imprinting of laser speckle pattern on directly driven thin foils with 1-2 μm spatial resolution. Results from these experiments as well as our use of x-ray laser moiré deflectometry to measure the electron density profile in ICF hohlraums will be discussed.

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